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An Electromyographic Study of the Oral and Facial Musculature

Contract Number DA-49-007-MD-721

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This report covers the work done on Contract #DA-49-007-MD-721 from 1 January 1962 to 31 December 1962.

Summary:

During the past grant year our work has been concentrated in two primary areas:

- (a) the physiology of swallowing and
- (b) the recording of jaw relationships during various physiologic functions, e.g. swallowing, without the use of an apparatus connected to the patient.

## I. Laboratory facilities and equipment changes

During the past year we have installed a new 8 channel Minneapolis-Honeywell physiologic recording system consisting of amplifiers and galvanometers and a Visicorder permitting recording frequencies of up to 8,000 c.p.s. The system is one of the finest for our purposes. It was purchased by funds from another grant but is used in conjunction with the equipment purchased by this army grant. The tape recorder and computer system which was envisaged could not be purchased since our previous recorder was not a satisfactory input for them. The new recorder is compatible with the planned computer system and when funds are available we hope to install such a system.

## II. Vertical Dimension Studies

Our work in this area is finished and two papers have been published. One of these concerns itself with the physiological mechanisms regulating vertical dimension (Storey) and the other is a more clinically oriented study of the rest position (Garnick and Ramfjord). The methods have been summarized in previous progress reports, the findings are contained in the reprints which accompany this report.

## III. Swallowing

### Method:

In addition to the analysis of the EMG patterns in the various types of swallows, as described in previous progress reports, we are attempting to study the mandible's position during swallowing (see section IV).

### Findings:

A variety of different swallowing patterns are seen in the Vth and VIIth cranial nerve muscles we are sampling. Abnormal swallowing often accompanies tongue thrusting and may or may not be seen with abnormal tongue posture. Both the tongue thrusting and abnormal posture are etiologic to certain malocclusions and make accomodation to dentures difficult.

We have devised and are using tongue training methods based on our swallowing research. One publication has resulted thus far (Moyers, Robert E. "The Role of Musculature in Orthodontic Diagnosis and Treatment Planning" in Vistas in Orthodontics ed. Kraus, B.S. and Riedel, R.A. Lea & Febiger, Philadelphia 1962 pp. 309-327). Our work continues in this area. On another grant we are probing the developmental aspects of this problem, but on the army grant we are concentrating on the clinical, i.e. the correction and diagnosis of abnormal swallowing and tongue thrusting.

### IV. Recording Jaw Relationships During Function

Our application for funds describes the method we now are using to ascertain just where the jaw is during several functions. By combining these intraoral transmitters with electromyography we should be able to learn with what frequency the mandible occludes in each position, what the muscles are doing at that time, and which of several occlusal positions is the more physiologically tenable for occlusal reconstruction or dentures. At the present time our transmitter allows five occlusal positions to be monitored.

The size of the battery is the most limiting. If the battery manufacturers are able to supply us with a smaller one, we should then be able to monitor perhaps eight positions.

The design of a satisfactory circuit was an important breakthrough for us, but its micro-miniaturization and precise positioning in a subject's mouth have been found to be even more difficult. Quite frankly, a disappointing number of component parts have been destroyed during the construction of a workable transmitter circuit. The circuits are assembled under a microscope and our dental training is of some advantage to us.

Detailed findings are not yet available.

#### V. Analysis of Relapse in Treated Malocclusions

This work is completed and is being prepared for publication. An important finding was the frequency with which retained abnormal swallowing and tongue thrusting were the direct cause of the relapse.

#### VI. Periodontal Sensory Thresholds

Some time last year was spent in the design of an instrument to study periodontal sensory thresholds. A successful design was worked out and the research is being supported on another research grant.

#### VII. Dental and Gingival Thermal Receptors

An instrument has been designed which enables us to map precisely the location of heat and cold receptors on the teeth and gingivae and their thresholds. The instrument is surprisingly reliable (to a fraction of a degree) and is providing us with

excellent data. The problem of thermal sensitivity is an important one yet no one, to our knowledge, has mapped precisely the thermal receptors in the mouth. Our first study, on the cervical areas, is progressing well and should be ready for reporting by early summer. We envisage a series of worthwhile papers in this area without any further investment of money for instrumentation.